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STILLWATER LAKE MONROE COUNTY, PENNSYLVANIA

Pacific Northwest Environmental
Research Laboratory

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16. ABSTRACT

Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivided according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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NATIONAL EUTROPHICATION SURVEY

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REPORT
ON
STILLWATER LAKE
MONROE COUNTY
PENNSYLVANIA

EPA REGION III

WORKING PAPER No. 427

WITH THE COOPERATION OF THE

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL RESOURCES

AND THE

PENNSYLVANIA NATIONAL GUARD

JUNE, 1975

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FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Pennsylvania Department of Environmental Resources for professional involvement and to the Pennsylvania National Guard for conducting the tributary sampling phase of the Survey.

Walter A. Lyon, Director of the Bureau of Water Quality Management, Richard M. Boardman, Chief of the Division of Water Quality, and James T. Ulanoski, Aquatic Biologist of the Division of Water Quality, provided invaluable lake documentation and counsel during the Survey, reviewed the preliminary reports, and provided critiques most useful in the preparation of this Working Paper series.

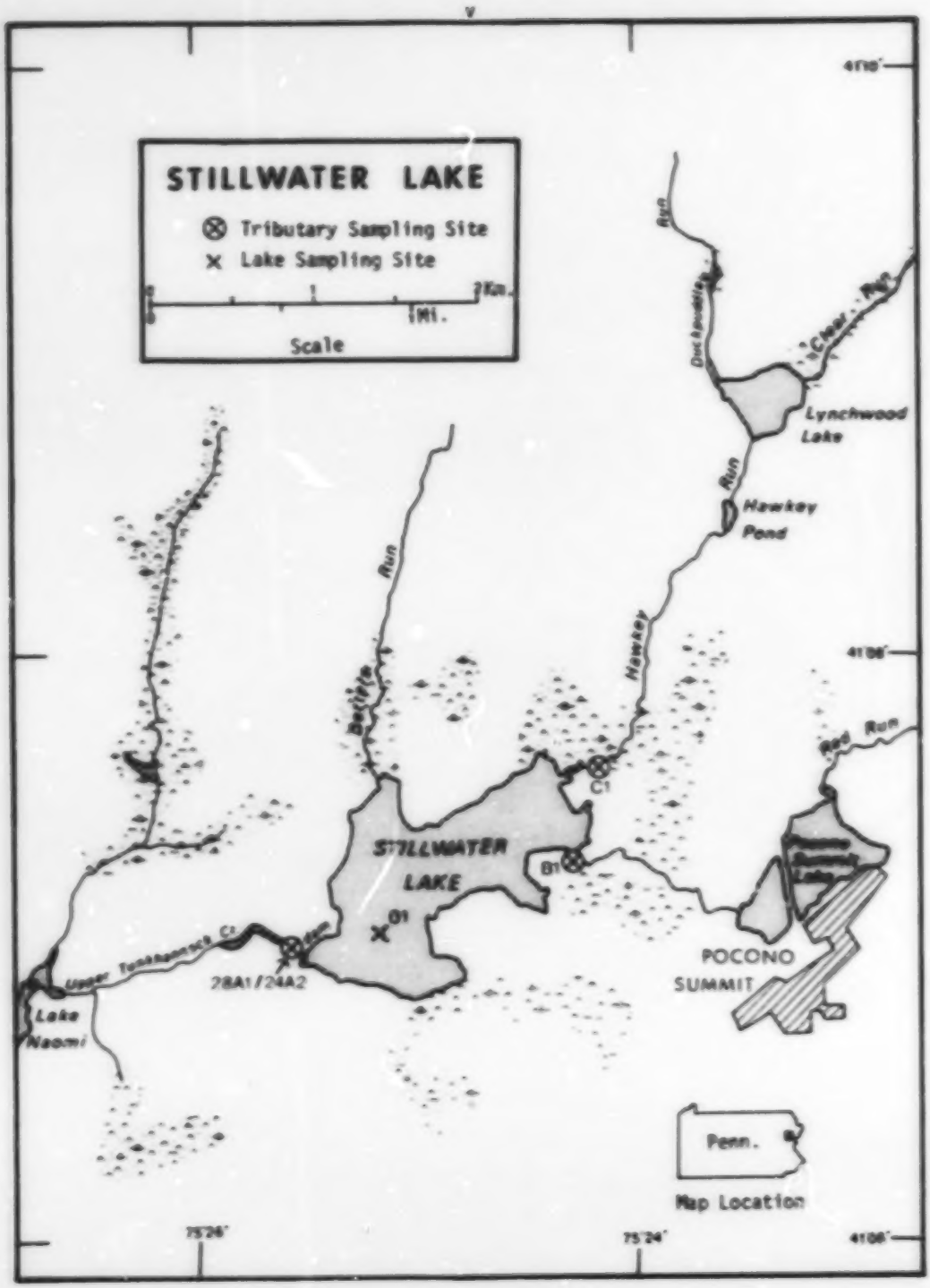
Major General Harry J. Mier, Jr., the Adjutant General of Pennsylvania, and Project Officer Major Ronald E. Wickard, who directed the volunteer efforts of the Pennsylvania National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF PENNSYLVANIA

LAKE NAME	COUNTY
Allegheny Reservoir	McKean, Warren, PA; Cattaraugus, NY
Beaver Run Reservoir	Westmoreland
Beltzville	Carbon
Blanchard Reservoir	Centre
Canadohta	Crawford
Conneaut	Crawford
Conewago (Pinchot)	York
Greenlane	Montgomery
Harveys	Luzerne
Indian	Somerset
Naomi	Monroe
Ontelaunee	Berks
Pocono	Monroe
Pymatuning Reservoir	Crawford, PA; Ashtabula, OH
Shenango River Reservoir	Mercer
Stillwater	Monroe
Wallenpaupack	Pike, Wayne


STILLWATER LAKE
Tributary Sampling Site
Lake Sampling Site
0
1
2Km.
1Mi.
Scale
Lynchwood Lake
Hawkey Pond
Hawkey Run
Bella Vista Run
Red Run
C1
B1
D1
STILLWATER LAKE
POCONO SUMMIT
28A1/24A2
Lake Naomi
Penn.
Map Location
75°26'
75°24'
41°08'
41°06'

STILLWATER LAKE*

STORET NO. 4228

I. CONCLUSIONS

A. Trophic Condition:

Survey data indicate that Stillwater Lake is mesotrophic. It ranked fourth in overall trophic quality when the 17 Pennsylvania lakes sampled in 1973 were compared using a combination of six lake parameters**. Four of the lakes had less and two had the same median total phosphorus, none had less median dissolved phosphorus, four had less and one had the same median inorganic nitrogen, 12 had less mean chlorophyll a, and ten had greater mean Secchi disc transparency.

Survey limnologists did not observe surface algae but did note rooted aquatic plants near the middle of the lake.

B. Rate-Limiting Nutrient:

The algal assay results indicate that Stillwater Lake was phosphorus limited when the sample was collected (04/17/73). The lake data indicate phosphorus limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--The estimated phosphorus contribution from septic tanks serving shoreline dwellings was less than 2%

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* Table of metric conversions--Appendix A.
** See Appendix B.

of the total load reaching Stillwater Lake during the sampling year. The present phosphorus loading rate of 0.25 $g/m^2/yr$ is less than that proposed by Vollenweider (Vollenweider and Dillon, 1974) as an oligotrophic rate (see page 11). However, any phosphorus inputs should be minimized to the greatest practicable extent to maintain the existing trophic condition of Stillwater Lake.

2. Non-point sources--Over 98% of the total phosphorus input to Stillwater Lake was contributed by non-point sources during the sampling year. Hawkeye Run contributed 32.4%, and the unnamed stream (B-1) contributed 31%. Ungaged tributaries were estimated to have contributed 28.2% of the total phosphorus load.

The phosphorus exports of both tributaries were quite low during the sampling year (see page 11) and compare well with the exports of the three tributaries of nearby Pocono Lake* (mean of 10 $kg/km^2/yr$; range of 5 to 14 $kg/km^2/yr$).

* Working Paper No. 424.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry†:

1. Surface area: 1.41 kilometers².
2. Mean depth: 1.0 meters.
3. Maximum depth: 2.4 meters.
4. Volume: 1.410×10^6 m³.
5. Mean hydraulic retention time: 23 days.

B. Tributary and Outlet:
(See Appendix C for flow data)

1. Tributaries -

Name	Drainage area (km²)*	Mean flow (m³/sec)*
Unnamed Stream (B-1)	8.9	0.2
Hawkey Run	14.9	0.3
Minor tributaries & immediate drainage -	9.8	0.2
Totals	33.6	0.7

2. Outlet -

Upper Tunkhannock Creek	35.9**	0.7

C. Precipitation***:

1. Year of sampling: 149.0 centimeters.
2. Mean annual: 120.3 centimeters.

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† Ulanoski, 1975.
* For limits of accuracy, see Working Paper No. 175, "...Survey Methods, 1973-1976".
** Includes area of lake.
*** See Working Paper No. 175.

III. LAKE WATER QUALITY SUMMARY

Stillwater Lake was sampled three times during the open-water season of 1973 by means of a pontoon-equipped Huey helicopter. Each time, surface samples for physical and chemical parameters were collected from one station on the lake (see map, page v). During each visit, a depth-integrated sample (near bottom to surface) was collected for phytoplankton identification and enumeration; and a similar sample was collected for chlorophyll a analysis. During the first visit, a single 18.9-liter depth-integrated sample was taken for algal assays. Only surface samples were collected for chemical analyses.

The lake sampling results are presented in full in Appendix D and are summarized in the following table.

a. SUMMARY OF PHYSICAL AND CHEMICAL CHARACTERISTICS FOR STILLWATER LAKE
STORET CODE 4220

	1ST SAMPLING (4/17/73)			2ND SAMPLING (7/23/73)			3RD SAMPLING (10/ 3/73)		
	1 SITES			1 SITES			1 SITES		
PARAMETER	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN	RANGE	MEAN	MEDIAN
TEMP (C)	10.0 - 10.0	10.0	10.0	22.9 - 22.9	22.9	22.9	17.1 - 17.1	17.1	17.1
DISS OXY (MG/L)	10.7 - 10.7	10.7	10.7	7.1 - 7.1	7.1	7.1	8.8 - 8.8	8.8	8.8
CNDCTVY (MCMHO)	50. - 50.	50.	50.	33. - 33.	33.	33.	30. - 30.	30.	30.
PH (STAND UNITS)	7.0 - 7.0	7.0	7.0	9.2 - 9.2	9.2	9.2	8.1 - 8.1	8.1	8.1
TOT ALK (MG/L)	10. - 10.	10.	10.	10. - 10.	10.	10.	10. - 10.	10.	10.
TOT P (MG/L)	0.015 - 0.015	0.015	0.015	0.016 - 0.016	0.016	0.016	0.015 - 0.015	0.015	0.015
ORTHO P (MG/L)	0.007 - 0.007	0.007	0.007	0.004 - 0.004	0.004	0.004	0.004 - 0.004	0.004	0.004
NO2+NO3 (MG/L)	0.140 - 0.140	0.140	0.140	0.070 - 0.070	0.070	0.070	0.030 - 0.030	0.030	0.030
AMMONIA (MG/L)	0.040 - 0.040	0.040	0.040	0.110 - 0.110	0.110	0.110	0.050 - 0.050	0.050	0.050
KJEL N (MG/L)	0.500 - 0.520	0.366	0.500	0.500 - 0.500	0.500	0.500	0.680 - 0.680	0.680	0.680
INORG N (MG/L)	0.180 - 0.180	0.180	0.180	0.100 - 0.100	0.100	0.100	0.080 - 0.080	0.080	0.080
TOTAL N (MG/L)	0.640 - 0.640	0.640	0.640	0.570 - 0.570	0.570	0.570	0.630 - 0.630	0.630	0.630
CHLRPHYL A (UG/L)	42.2 - 42.2	42.2	42.2	5.8 - 5.8	5.8	5.8	0.7 - 0.7	0.7	0.7
SECCHI (METERS)	1.5 - 1.5	1.5	1.5	1.5 - 1.5	1.5	1.5	0.8 - 0.8	0.8	0.8

B. Biological characteristics:

1. Phytoplankton* -

Sampling Date	Dominant Genera	Algal units per ml
07/23/75	1. Peridinium	391
	2. Coccoid Chlorophyta cells	112
	3. Cryptomonas	74
	4. Synedra	56
	5. Flagellates	37
	Other genera	76
	Total	746
10/03/73	1. Chlorella	5,236
	2. Flagellates	237
	3. Melosira	79
	4. Eunotia	68
	5. Glenodinium	45
	Other genera	112
	Total	5,777

2. Chlorophyll a -

Sampling Date	Station Number	Chlorophyll a (µg/l)
04/17/73	01	42.2
07/23/73	01	5.8
10/03/73	01	6.7

* The April sample was lost in shipment.

C. Limiting Nutrient Study:

1. Autoclaved, filtered, and nutrient spiked -

Spike (mg/l)	Ortho P Conc. (mg/l)	Inorganic N Conc. (mg/l)	Maximum yield (mg/l-dry wt.)	N/P Ratio
Control	0.008	0.140	0.1	18/1
0.050 P	0.058	0.140	2.0	2/1
0.050 P + 1.0 N	0.058	1.140	14.2	20/1
1.0 N	0.008	1.140	0.1	142/1

2. Discussion -

The control yield of the assay alga, Selenastrum capricornutum, indicates that the potential primary productivity of Stillwater Lake was low at the time the sample was collected. An increase in yield occurred when only phosphorus was added, but no increase occurred with the addition of only nitrogen. Therefore, phosphorus limitation is indicated.

The relatively small increase in yield resulting from the orthophosphorus spike was due to the shift to nitrogen limitation when the excess phosphorus was added (note the change in the N/P ratios). The control sample would have become nitrogen limited with the addition of only about 0.002 mg/l of orthophosphorus so about 96% of the 0.050 mg/l spike could not be utilized by the assay algae. Hence the small growth response to the phosphorus addition.

The lake data substantiate phosphorus limitation. At all sampling times, the mean N/P ratios were 22/1 or greater and phosphorus limitation would be expected.

IV. NUTRIENT LOADINGS
(See Appendix E for data)

For the determination of nutrient loadings, the Pennsylvania National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for the high runoff months of February and March when two samples were collected. Sampling was begun in May, 1973, and was completed in April, 1974.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Pennsylvania District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for unsampled "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated using the means of the nutrient loads, in $kg/km^2/year$, at stations B-1 and C-1 and multiplying the means by the ZZ area in km^2.

Other than septic tanks, there were no known point sources impacting Stillwater Lake during the Survey sampling year.

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* See Working Paper No. 175.

A. Waste Sources:

1. Known municipal - None

2. Known industrial - None

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	kg P/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Stream (B-1)	110	31.0
Hawkey Run	115	32.4
b. Minor tributaries & immediate drainage (non-point load) -	100	28.2
c. Known municipal STP's - None	-	-
d. Septic tanks* -	5	1.4
e. Known industrial - None	-	-
f. Direct precipitation** -	25	7.0
Total	355	100.0

2. Outputs -

Lake outlet - Upper Tunkhannock Creek	355

3. Net annual P accumulation - none

* Estimate based on 10 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	kg N/ yr	% of total
a. Tributaries (non-point load) -		
Unnamed Stream (B-1)	5,190	27.1
Hawkey Run	7,140	37.3
b. Minor tributaries & immediate drainage (non-point load) -	5,205	27.2
c. Known municipal STP's - None	-	-
d. Septic tanks* -	105	0.5
e. Known industrial - None	-	-
f. Direct precipitation** -	1,520	7.9
Total	19,160	100.0

2. Outputs -

Lake outlet - Upper Tunkhannock Creek	13,820

3. Net annual N accumulation - 5,340 kg.

* Estimate based on 10 lakeshore dwellings; see Working Paper No. 175.
** See Working Paper No. 175.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	kg P/km²/yr	kg N/km²/yr
Unnamed Stream (B-1)	12	583
Hawkey Run	8	479

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (Vollenweider and Dillon, 1974). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with short hydraulic retention times.

	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
grams/m²/yr	0.25	none	13.6	3.8

Vollenweider loading rates for phosphorus ($g/m^2/yr$) based on mean depth and mean hydraulic retention time of Stillwater Lake:

"Dangerous" (eutrophic rate)	0.76
"Permissible" (oligotrophic rate)	0.38

V. LITERATURE REVIEWED

Ulanoski, James, 1975. Personal communication (lake morphometry). PA Dept. of Env. Resources, Harrisburg.

Vollenweider, R. A., and P. J. Dillon, 1974. The application of the phosphorus loading concept to eutrophication research. Natl. Res. Council of Canada Publ. No. 13690, Canada Centre for Inland Waters, Burlington, Ontario.

CONVERSION FACTORS

Hectares x 2.471 = acres

Kilometers x 0.6214 = miles

Meters x 3.281 = feet

Cubic meters x 8.107×10^{-4} = acre/feet

Square kilometers x 0.3861 = square miles

Cubic meters/sec x 35.315 = cubic feet/sec

Centimeters x 0.3937 = inches

Kilograms x 2.205 = pounds

Kilograms/square kilometer x 5.711 = lbs/square mile

LAKES RANKED BY INDEX NOS.

RANK	LAKE CODE	LAKE NAME	INDEX NO
1	4224	LAKE NAOMI	445
2	4220	BELTZVILLE DAM	423
3	4222	HARVEY'S LAKE	413
4	4228	STILLWATER LAKE	401
5	4227	POCONO LAKE	389
6	4223	INDIAN LAKE	388
7	3641	ALLEGHENY RESERVOIR	385
8	4229	LAKE WALLENPAUPACK	371
9	4221	CANADOHTA LAKE	369
10	4219	BEAVER RUN RESERVOIR	360
11	4204	CONNEAUT LAKE	307
12	4226	PINCHOT LAKE	256
13	4213	PYMATUNING RESERVOIR	206
14	4216	SHENANGO RIVER RESERVOIR	157
15	4225	ONTELAUNEE DAM	101
16	4201	BLANCHARD RESERVOIR	85
17	4207	GREENLANE DAM	53

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	1S-MIN DO	MEDIAN DISS P	INDEX NO
3641	ALLEGHENY RESERVOIR	56 (9)	38 (6)	63 (10)	100 (16)	69 (11)	50 (8)	385
4201	BLANCHARD RESERVOIR	13 (2)	13 (2)	25 (4)	31 (5)	3 (0)	0 (0)	85
4204	CONNEAUT LAKE	44 (7)	63 (10)	69 (11)	56 (9)	34 (5)	41 (6)	307
4207	GREENLANE DAM	6 (1)	6 (1)	19 (3)	13 (2)	3 (0)	6 (1)	53
4213	PYMATUNING RESERVOIR	0 (0)	72 (11)	6 (1)	0 (0)	100 (16)	28 (4)	206
4216	SHENANGO RIVER RESERVOIR	19 (3)	44 (7)	13 (2)	6 (1)	47 (7)	28 (4)	157
4219	BEAVER RUN RESERVOIR	94 (15)	19 (3)	88 (14)	81 (13)	19 (2)	59 (8)	360
4220	BELTZVILLE DAM	86 (14)	25 (4)	94 (15)	94 (15)	34 (5)	88 (13)	423
4221	CANADOHTA LAKE	50 (8)	97 (15)	56 (9)	19 (3)	59 (9)	86 (13)	369
4222	HARVEY'S LAKE	63 (10)	81 (13)	100 (16)	63 (10)	47 (7)	59 (8)	413
4223	INDIAN LAKE	100 (16)	31 (5)	75 (12)	75 (12)	19 (2)	88 (13)	388
4224	LAKE NAOMI	81 (13)	88 (14)	44 (7)	69 (11)	88 (14)	75 (12)	445
4225	ONTELAUNEE DAM	25 (4)	0 (0)	0 (0)	44 (7)	19 (2)	13 (2)	101
4226	PINCHOT LAKE	31 (5)	56 (9)	31 (5)	38 (6)	81 (13)	19 (3)	256
4227	POCONO LAKE	38 (6)	97 (15)	50 (8)	88 (14)	75 (12)	41 (6)	389
4228	STILLWATER LAKE	72 (11)	72 (11)	38 (6)	25 (4)	94 (15)	100 (16)	401
4229	LAKE WALLENPAUPACK	72 (11)	50 (8)	81 (13)	50 (8)	59 (9)	59 (8)	371

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	MEDIAN TOTAL P	MEDIAN INORG N	500-MEAN SEC	MEAN CHLORA	15-MIN DO	MEDIAN DISS P
3641	ALLEGHENY RESERVOIR	0.010	0.380	414.250	3.700	13.800	0.006
4201	BLANCHARD RESERVOIR	0.064	1.300	453.143	15.187	14.900	0.046
4204	CONNEAUT LAKE	0.023	0.185	402.000	7.567	14.600	0.007
4207	GREENLANE DAM	0.066	1.475	460.222	24.011	14.900	0.020
4213	PYMATUNING RESERVOIR	0.070	0.180	467.750	56.333	7.700	0.008
4216	SHENANGO RIVER RESERVOIR	0.058	0.340	463.555	26.800	14.500	0.008
4219	BEAVER RUN RESERVOIR	0.009	0.435	384.833	5.183	14.800	0.006
4220	BELTZVILLE DAM	0.010	0.815	362.444	4.856	14.600	0.005
4221	CANADOHTA LAKE	0.020	0.130	436.000	19.167	14.100	0.005
4222	HARVEY'S LAKE	0.015	0.160	338.000	5.967	14.500	0.006
4223	INDIAN LAKE	0.008	0.520	400.222	5.211	14.800	0.005
4224	LAKE NAOMI	0.014	0.135	443.333	5.533	8.000	0.005
4225	ONTELAUNEE DAM	0.040	2.150	470.667	11.783	14.800	0.011
4226	PINCHOT LAKE	0.027	0.245	453.000	13.950	11.500	0.008
4227	POCONO LAKE	0.024	0.130	438.800	4.980	13.200	0.007
4228	STILLWATER LAKE	0.015	0.180	449.000	18.233	7.900	0.004
4229	LAKE WALLENPAUPACK	0.015	0.250	394.583	9.617	14.100	0.006

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4228 STILLWATER LAKE

TOTAL DRAINAGE AREA OF LAKE(SQ KM) 35.0

TRIBUTARY	SUB-DRAINAGE AREA(SQ KM)	NORMALIZED FLOWS(CMS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
4228A1	35.0	0.06	0.04	1.05	1.16	0.06	0.04	0.01	0.05	0.31	0.42	0.08	0.76	0.68
4228M1	4.9	0.13	0.15	0.28	0.37	0.23	0.12	0.09	0.08	0.04	0.07	0.14	0.17	0.16
4228C1	10.9	0.24	0.31	0.61	0.57	0.42	0.21	0.22	0.19	0.12	0.18	0.28	0.34	0.31
4228Z1	11.2	0.25	0.32	0.25	0.23	0.22	0.20	0.20	0.18	0.14	0.18	0.25	0.25	0.22

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 35.0
SUM OF SUB-DRAINAGE AREAS = 35.0

TOTAL FLOW IN = 0.19
TOTAL FLOW OUT = 0.18

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4228A1	5	73	1.33	14	1.76				
	6	73	1.01	23	0.82				
	7	73	0.82	14	0.71				
	8	73	0.54	9	1.10				
	9	73	0.37	8	0.29				
	10	73	0.80	13	0.25				
	11	73	0.91	10	0.82				
	12	73	1.05	8	1.09				
	1	74	1.10	12	0.79				
	2	74	0.82	9	0.51				
	3	74	1.04	10	1.05				
	4	74	1.30	13	1.25				
4228M1	5	73	0.31	14	0.27				
	6	73	0.21	23	0.12				
	7	73	0.14	14	0.13				
	8	73	0.10	9	0.11				
	9	73	0.05	8	0.03				
	10	73	0.05	13	0.03				
	11	73	0.09	10	0.07				
	12	73	0.08	8	0.01				
	1	74	0.28	12	0.17				
	2	74	0.19	9	0.05				
	3	74	0.29	10	0.20				
	4	74	0.30	13	0.36				

TRIBUTARY FLOW INFORMATION FOR PENNSYLVANIA 1/27/75

LAKE CODE 4228 STILLWATER LAKE

MEAN MONTHLY FLOWS AND DAILY FLOWS(CMS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
4228C1	5	73	0.57	19	0.79				
	6	73	0.74	23	0.26				
	7	73	0.34	14	0.31				
	8	73	0.23	4	0.51				
	9	73	0.15	8	0.09				
	10	73	0.16	13	0.11				
	11	73	0.21	10	0.17				
	12	73	0.88	8	0.74				
	1	74	0.48	12	0.34				
	2	74	0.34	9	0.20				
	3	74	0.48	16	0.45				
	4	74	0.57	13	0.54				
4228Z1	5	73	0.34	19	0.45				
	6	73	0.54	23	0.21				
	7	73	0.34	14	0.28				
	8	73	0.22	4	0.45				
	9	73	0.17	8	0.11				
	10	73	0.17	13	0.12				
	11	73	0.19	10	0.16				
	12	73	0.65	8	0.54				
	1	74	0.40	12	0.28				
	2	74	0.26	9	0.16				
	3	74	0.40	16	0.34				
	4	74	0.40	13	0.37				

APPENDIX D

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/01/27

422801
41 07 05.0 075 25 10.0
STILLWATER LAKE
42089 PENNSYLVANIA

11EPALES 2111202
3 0005 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CND/CTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P
73/04/17	11 05	0000	10.0	10.7	60	58	7.80	10K	0.040	0.500	0.140	0.007
73/07/23	10 45	0000	22.9	7.1	60	33	5.20	10K	0.110	0.500	0.070	0.004
73/10/03	16 15	0000	17.1	8.8	33	30	6.10	10K	0.050	0.600	0.030	0.004

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DATE FROM TO	TIME OF DAY	DEPTH FEET	00665 PHOS-TOT MG/L P	32217 CHLRPHYL A UG/L
73/04/17	11 05	0000	0.015	2.2
73/07/23	10 45	0000	0.016	5.8
73/10/03	16 15	0000	0.015	6.7

K VALUE KNOWN TO BE
LESS THAN INDICATED

APPENDIX E

TRIBUTARY DATA

STORET RETRIEVAL DATE 75/02/03

422BA1
41 07 02.0 075 25 31.0
UPPER TUNKHANNUCK LAKE
42089 7.5 POCONO PINES
D/STILLWATER LAKE
SEC RD BRDG BELOW DAM
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	15 15		0.052	0.320	0.005K	0.005K	0.015
73/06/23	10 05		0.017	0.460	0.038	0.006	0.020
73/07/14	10 05		0.017	1.000	0.210	0.014	0.015
73/08/05	10 30		0.010K	0.260	0.022	0.005K	0.015
73/09/09	10 00		0.010K	0.480	0.029	0.005K	0.015
73/10/07	11 00		0.010K	0.300	0.019	0.006	0.010
73/11/11	13 10		0.052	0.800	0.034		0.020
73/12/09	11 45		0.096	0.400	0.020	0.005K	0.015
74/01/06	10 05		0.140	0.200	0.028	0.005K	0.010
74/02/09	14 00		0.148	0.300	0.065	0.005K	0.010
74/02/23	14 25		0.200	0.300	0.020	0.015	0.025
74/03/16	09 45		0.152	0.500	0.025	0.005	0.025
74/03/30	12 30		0.136	0.600	0.060	0.005	0.015
74/04/13	11 35		0.112	0.300	0.015	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

422881
41 07 18.0 075 24 13.0
UNNAMED CREEK
42 7.5 PUCONO PINES
1/STILLWATER LAKE
CULVERT ON UNDRY RD AT E END OF LAKE
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/19	14 45		0.060	0.380	0.021	0.005K	0.015
73/06/23	10 00		0.052	0.960	0.046	0.011	0.030
73/07/14	09 15		0.013	0.920	0.231	0.014	0.025
73/08/05	09 50		0.010K	0.850	0.026	0.005K	0.030
73/09/04	09 30		0.028	2.400	0.126	0.009	0.035
73/10/07	10 30		0.018	0.700	0.040	0.008	0.020
73/11/11	12 50		0.084	1.050	0.044	0.012	0.030
73/12/09	11 30		0.112	0.600	0.036	0.005K	0.015
74/01/06	09 40		0.160	0.900	0.044	0.005K	0.010
74/02/04	13 50		0.168	2.000	0.115	0.005	0.015
74/02/23	13 50		0.216	0.500	0.035	0.015	0.025
74/03/16	11 00		0.144	0.400	0.030	0.010	0.025
74/03/30	15 00		0.108	1.300	0.065	0.005K	0.010
74/04/13	10 00		0.076	0.400	0.020	0.005K	0.015

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/03

4228C1
41 07 40.0 075 24 10.0
HAWKEY RUN
42 7.5 TOBYHANNA
T/STILLWATER LAKE
FOREST LANE BRDG AT NE TIP OF LAKE
11EPALES 2111204
0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
73/05/14	15 00		0.176	0.425	0.059	0.005K	0.010
73/06/23	10 10		0.168	0.250	0.038	0.005K	0.010
73/07/14	09 20		0.102	0.800	0.210	0.010	0.010
73/08/05	10 00		0.115	0.160	0.015	0.005K	0.015
73/09/04	09 35		0.189	2.150	0.080	0.005K	0.005K
73/10/07	10 40		0.140	0.350	0.026	0.005K	0.005K
73/11/11	12 55		0.240	1.000	0.028	0.008	0.008
73/12/09	11 25		0.200	0.300	0.020	0.005K	0.010
74/01/06	09 45		0.312	0.100K	0.008	0.005K	0.005K
74/02/04	14 00		0.320	0.200	0.015	0.010	0.030
74/02/23	14 00		0.288	0.700	0.050	0.005K	0.025
74/03/16	11 45		0.252	0.400	0.030	0.005	0.005
74/03/30	12 15		0.264	0.400	0.040	0.005K	0.005
74/04/13	10 05		0.224	0.100	0.010	0.005K	0.015

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K VALUE KNOWN TO BE
LESS THAN INDICATED